

THEORY OF FLIGHT

COURSE DESCRIPTION

Theory of Flight is a course that continues and completes the presentation of knowledge and procedures required for the ground school (knowledge) portion of the Federal Aviation Administration (FAA) private pilot license, begun in *Introduction to Aerospace*. Students will explore the flight environment and weather formation and assess how weather data and other factors impact safety and flight operations. The course also covers Federal Aviation Administration (FAA) regulations affecting private pilot operations; predicting aircraft performance, weight, and balance; types of navigation in pilotage and dead reckoning; aviation physiology and aeronautical decision-making; and cross-country flying.

Prerequisite(s): Introduction to Aerospace

Recommended Credits: 1

Recommended Grade Level(s): 11 - 12

Note: Course must be taught by FAA certified instructor (Ground Instructor rating for those individuals teaching ground school only, FAA Flight Instructor certification is required for those individuals teaching flight instruction.) Flight Instructor certification qualifies individuals to teach ground school and flight instruction.

THEORY OF FLIGHT STANDARDS

- 1.0 Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.
- 2.0 Students will analyze the flight environment and its relationship to safety.
- 3.0 Students will assess communication and flight information systems.
- 4.0 Students will analyze weather formation and hazards to aircraft operations and interpret weather data.
- 5.0 Students will demonstrate comprehension of Federal Aviation Regulations that apply to private pilot operations.
- 6.0 Students will examine principles of aerodynamics used to predict aircraft performance and weight and balance.
- 7.0 Students will examine the various types of navigation in pilotage and dead reckoning.
- 8.0 Students will analyze human factor principles and identify their effect on aviation physiology and aeronautical decision making.
- 9.0 Students will examine cross-country flying.
- 10.0 Students will demonstrate communication skills required in the aviation industry.
- 11.0 Students will demonstrate interpersonal and employability skills required in the aviation industry.

THEORY OF FLIGHT

STANDARD 1.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

LEARNING EXPECTATIONS

The student will:

- 1.1 Lead a team.
- 1.2 Participate in SkillsUSA-VICA as an integral part of classroom instruction.
- 1.3 Assess client complaint and apply problem-solving and decision-making skills to communicate with the client.
- 1.4 Demonstrate teamwork skills.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student will:

- 1.1.A As a team leader, demonstrates character and leadership skills to accomplish a project.
- 1.1.B Evaluates the effectiveness of a team and develops a plan for improvement.
- 1.2.A Applies the points of the creed in the classroom and laboratory.
- 1.2.B Demonstrates rules of parliamentary procedure to express ideas to a group.
- 1.3.A Analyzes situations in the workplace and uses conflict resolution techniques to solve the problem.
- 1.4 Participates in a group to diagnose electrical systems.

SAMPLE PERFORMANCE TASKS

- Analyze the classroom and laboratory structure. Compile a proposal to organize the classroom and laboratory to show improvement in effectiveness.
- Participate in various SkillsUSA-VICA programs and/or competitive events.
- Evaluate an activity within the school, community, and/or workplace and develop a plan for improvement using teamwork skills.
- Implement an annual program of work.
- Prepare a meeting agenda for a SkillsUSA-VICA monthly meeting.
- Attend a professional organization meeting or tradeshow relating to the automotive service industry.

INTEGRATION LINKAGES

SkillsUSA-VICA, *Professional Development Program*, SkillsUSA-VICA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Math for Technology, Applied Communications, Social Studies, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, SCANS (Secretary's Commission on Achieving Necessary Skills), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies

THEORY OF FLIGHT

STANDARD 2.0

Students will analyze the flight environment and its relationship to safety.

LEARNING EXPECTATIONS

The student will:

- 2.1 Analyze important safety considerations for flight and ground operations.
- 2.2 Differentiate between controlled and uncontrolled airports and their environments.
- 2.3 Interpret aeronautical charts.
- 2.4 Differentiate between controlled and uncontrolled airspace.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 2.1.A Examines collision avoidance precautions.
- 2.1.B Assesses right-of-way rules.
- 2.1.C Expresses how to determine minimum safe altitudes and visual flight rules (VFR) cruising altitudes.
- 2.2.A Determines the Air Traffic Control (ATC) communication requirements for pilots operating from a controlled airport.
- 2.2.B Outlines recommended communication procedures for uncontrolled airports.
- 2.2.C Compares and contrasts controlled and uncontrolled airport environments.
- 2.3.A Illustrates how aeronautical charts provide information to:
 - allow pilots track their position and
 - enhance safety.
- 2.3.B Points out three different types of aeronautical charts.
- 2.3.C Interprets aeronautical charts.
- 2.4.A Compares and contrasts controlled and uncontrolled airspace.
- 2.4.B Distinguishes the five classifications of controlled airspace.
- 2.4.C Points out the visual flight rules (VFR) minimums which apply to Class G airspace.

SAMPLE PERFORMANCE TASKS

- Review an aeronautical chart and extract specified data.
- Research and report on flight safety considerations involving air traffic.
- Diagram a simple air traffic situation, indicating where right-of-way rules apply and which collision avoidance precautions need to be taken by the aircraft shown.

INTEGRATION/LINKAGES

Science, Math, Geography, Research and Writing Skills, Technology Literacy, Computer Skills, Applied Communication, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA, Aviation Technical Education Council (ATEC), Federal Aviation Administration (FAA)

THEORY OF FLIGHT

STANDARD 3.0

Students will assess communication and flight information systems.

LEARNING EXPECTATIONS

The student will:

- 3.1.A Explore radar, transponder operations, and FAA radar equipment and services for visual flight rules (VFR) aircraft.
- 3.2 Examine radio equipment and procedures.
- 3.3 Access sources of flight information.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 3.1.A Illustrates the operations and uses of aviation radar.
- 3.1.B Analyzes the function and operation of the transponder and point outs when it is required to operate in controlled airspace.
- 3.1.C Determines under what conditions air traffic facilities provide radar assistance to visual flight rules (VFR) aircraft.
- 3.1.D Details the services offered to visual flight rules (VFR) aircraft; including safety alerts, traffic advisories, limited vectoring, and sequencing.
- 3.2.A Determines the radio requirements for flying in controlled airspace.
- 3.2.B Examines the operations and classifications of very high frequency (VHF) radio equipment.
- 3.2.C Uses proper radio phraseology and procedures.
- 3.3.A Uses the Airport/Facility Directory to locate information on airports.
- 3.3.B Decodes the information provided in the Airport/Facility Directory.
- 3.3.C Determines what information can be obtained from the Notices to Airmen (NOTAMS), including hazardous conditions and changes to Airport/Facility Directory information.

SAMPLE PERFORMANCE TASKS

- Demonstrate the use of two-way radio, using terminology found in the Pilot/Controller Glossary of the Aeronautical Information Manual (AIM) and the International Civil Aviation Organization (ICAO) alphabet.
- Use the Airport/Facility Directory to find information on a specific airport. Interpret the coded information and create a brief written summary.
- Diagram how the position of a rotating antenna of a radar site when the reflected portion of the radio wave is received determines the direction of a detected object.

INTEGRATION LINKAGES

Science, Math, Language Arts, Research and Writing Skills, Technology Literacy, Computer Skills, Applied Communication, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA, Aviation Technical Education Council (ATEC), Federal Aviation Administration (FAA)

THEORY OF FLIGHT

STANDARD 4.0

Students will analyze weather formation and hazards to aircraft operations and interpret weather data.

LEARNING EXPECTATIONS

The student will:

- 4.1 Examine basic weather theory and causes of various weather conditions, frontal systems and hazardous weather phenomena.
- 4.2 Explain how to recognize critical weather situations from the ground and during flight.
- 4.3 Distinguish sources of weather information during preflight planning and while in flight.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 4.1.A Characterizes the types and development of weather formations.
- 4.1.B Assesses the implications of various weather conditions for flight, including limited visibility, turbulence, and icing.
- 4.2.A Determines through observation how actual weather conditions may vary from weather station reports.
- 4.2.B Assesses flight hazards associated with thunderstorms and wind shear.
- 4.2.C Characterizes the different types of weather observation, including surface aviation weather, upper air, and radar observations.
- 4.2.D Analyzes pilot decision making in relation to weather conditions.
- 4.3.A Determines how to obtain preflight or inflight briefings from various sources, including:
 - Federal Aviation Administration (FAA) flight service station (FSS)
 - Pilot's Automatic Telephone Weather Answering System (PATWAS)
 - Transcribed Information Briefing Service (TIBS)
 - Direct User Access Terminal Service (DUATS)
 - Transcribed Weather Broadcast (TWEB)
- 4.3.B Deduces why it is important for a pilot to identify him/herself and provide as much information regarding the proposed flight as possible when requesting a briefing.
- 4.3.C Distinguishes the following types of weather briefings and the situation to which it applies:
 - Standard
 - Abbreviated
 - Outlook
- 4.3.A Interprets weather briefings and reports from surface aviation weather, upper air, and radar observations.
- 4.3.B Extracts weather data from various formats and charts.

SAMPLE PERFORMANCE TASKS

- Obtain a weather briefing from an assigned source and outline its implications for a flight.
- Compare a personal weather observation with information obtained from a weather report.

INTEGRATION LINKAGES

Science, Math, Language Arts, Technology Literacy, Decision Making Skills, Applied Communication, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA, Aviation Technical Education Council (ATEC), Federal Aviation Administration (FAA)

THEORY OF FLIGHT

STANDARD 5.0

Students will demonstrate comprehension federal regulations that apply to private pilot operations.

LEARNING EXPECTATIONS

The student will:

- 5.1 Examine private pilot privileges and limitations.
- 5.2 Evaluate National Transportation Safety Board (NTSB) accident reporting requirements and advisory circulars.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 5.1.A Interprets Federal Aviation Regulations (FAR) Part 1 definitions and abbreviations.
- 5.1.B Distinguishes between pilot certification for pilots/flight instructors according to Federal Aviation Regulations (FAR) Part 61.
- 5.1.C Assesses Federal Aviation Regulations (FAR) Part 91 general operating and flight rules.
- 5.2.A Interprets rules pertaining to National Transportation Safety Board (NTSB) Part 830.
- 5.2.B Examines the role of the Advisory Circular System.
- 5.2.C Interprets an advisory circular.

SAMPLE PERFORMANCE TASKS

- Outline the required steps for obtaining Federal Aviation Administration private pilot licensure.
- Review a sample National Transportation Safety Board (NTSB) accident report and analyze the reported data.

INTEGRATION LINKAGES

Science, Math, Language Arts, Research and Writing Skills, Technology Literacy, Computer Skills, Applied Communication, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA, Aviation Technical Education Council (ATEC), Federal Aviation Administration (FAA), National Transportation Safety Board (NTSB)

THEORY OF FLIGHT

STANDARD 6.0

Students will examine principles of aerodynamics used to predict aircraft performance and weight and balance.

LEARNING EXPECTATIONS

The student will:

- 6.1 Explore the effects of varying conditions on airplane performance.
- 6.2 Use relevant data to predict airplane performance.
- 6.3 Apply mathematical concepts to weight and balance.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 6.1.A Correlates the following factors with their effects on airplane performance:
 - density
 - altitude
 - humidity
 - wind
 - runway surface and gradient
 - ground effect
- 6.1.B Examines the effects of excessive weight and improper loading on airplane performance.
- 6.1.C Examines the effects of adverse balance on stability and control.
- 6.2.A Uses information drawn from Airplane Flight Manuals or Pilot's Operating Handbook to determine airplane performance.
- 6.2.B Calculates takeoff and landing distances.
- 6.2.C Calculates time, fuel, and distance to climb.
- 6.2.D Calculates wind correction and true airspeed.
- 6.2.E Solves speed, time, and distance problems.
- 6.3.A Computes airplane weight.
- 6.3.A Computes airplane balance.

SAMPLE PERFORMANCE TASKS

- Use a performance chart to determine density altitude.
- Calculate the length of the takeoff ground run and the total distance required to clear a 50-foot obstacle given specific data including airplane weight, headwind, pressure altitude, and temperature.
- Predict the effects of an excessive weight on the performance of a given airplane.
- For a proposed Visual Flight Rules (VFR) flight, with a maximum fuel load and gross weight, calculate the takeoff and landing center of gravity (CG), assuming a landing fuel reserve of 45 minutes.

INTEGRATION LINKAGES

Science, Math, Technology Literacy, Computer Skills, Applied Communication, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA, Aviation Technical Education Council (ATEC), Federal Aviation Administration (FAA)

THEORY OF FLIGHT

STANDARD 7.0

Students will examine the various types of navigation in pilotage and dead reckoning.

LEARNING EXPECTATIONS

The student will:

- 7.1 Analyze navigation by pilotage.
- 7.2 Analyze navigation by dead reckoning.
- 7.3 Examine the Very High Frequency OmniRange Navigation System (VOR).
- 7.4 Examine the use of ADF navigation equipment.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 7.1.A Demonstrates how landmarks and checkpoints are used in pilotage.
- 7.1.B Demonstrates how to track position from checkpoints using a sectional chart.
- 7.1.C Examines how pilotage can be used in conjunction with dead reckoning and Visual Flight Rules (VFR) radio navigation.
- 7.2.A Examines how computations are used to predict headings for navigation by dead reckoning.
- 7.2.B Uses time, airspeed, distance, and course to perform computations for dead reckoning.
- 7.2.C Determines the role the wind triangle plays in dead reckoning.
- 7.3.A Illustrates how the Very High Frequency OmniRange Navigation System (VOR) operates using a ground transmitter and the aircraft receiving equipment.
- 7.3.B Illustrates how the Very High Frequency OmniRange Navigation System (VOR) aids in navigation by displaying aircraft position relative to course.
- 7.4.A Compares and contrasts the absolute bearing information provided by Very High Frequency OmniRange Navigation System (VOR) equipment and relative bearing information provided by automatic direction finder (ADF) equipment.
- 7.4.B Identifies the role of the NONDIRECTIONAL RADIOBEACON (NDB) in navigation with an automatic direction finder (ADF).
- 7.4.C Compares and contrasts the effects of aircraft altitude on the reception of Very High Frequency OmniRange Navigation System (VOR) and NONDIRECTIONAL RADIOBEACON (NDB) radio signals.

SAMPLE PERFORMANCE TASKS

- For a proposed VFA flight of at least three legs, and predicted in-route weather, prepare a dead reckoning flight plan, including expected heading and ground speed for each leg, estimated time of arrival at each check point, total flight time, and fuel requirements.
- For each checkpoint above, determine and record all VOR and ADF bearings that could confirm the checkpoint.

INTEGRATION LINKAGES

Science, Math, Technology Literacy, Computer Skills, Applied Communication, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA, Aviation Technical Education Council (ATEC), Federal Aviation Administration (FAA)

THEORY OF FLIGHT

STANDARD 8.0

Students will analyze human factor principles and identify their effect on aviation physiology and aeronautical decision making.

LEARNING EXPECTATIONS

The student will:

- 8.1 Explore the factors that affect aeronautical decision making.
- 8.2 Explore techniques for enhancing safety in the cockpit by improving pilot judgment and decision making skills.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 8.1.A Examines pilot-in-command responsibilities.
- 8.1.B Evaluates the role of communication in aviation.
- 8.2.A Analyzes and applies resource use concepts.
- 8.2.B Relates workload management practices to successful outcomes.
- 8.2.C Analyzes situational awareness factors.

SAMPLE PERFORMANCE TASKS

- Discuss the role of risk management in successful decision making.
- Complete a stress level self-assessment and discuss how stress management impacts pilot decision making.
- Research and present results on how physiological factors affected a specific flight accident.

INTEGRATION LINKAGES

Science, Business, Technology Literacy, Applied Communication, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA, Aviation Technical Education Council (ATEC), Federal Aviation Administration (FAA)

THEORY OF FLIGHT

STANDARD 9.0

Students will examine cross-country flying.

LEARNING EXPECTATIONS

The student will:

- 9.1 Follow recommended procedures and guidelines for flight planning.
- 9.2 Perform mathematical computations for flight.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 9.1.A Demonstrates procedures for filing an FAA flight plan in person, by phone, or by radio after takeoff.
- 9.1.B Collects the following information in preparation for a flight:
 - Current weather reports and forecasts
 - Fuel requirements
 - Alternatives available if flight cannot be completed
 - Traffic delays reported by air traffic control (ATC)
 - Specific airport information from the Airport /Facility Directory
- 9.1.C Assembles necessary materials including the appropriate current sectional chart, flight computer or electronic calculator, and plotter.
- 9.2.A Uses the Airplane Flight Manual or Pilot's Operation Handbook to determine the proper loading of the airplane based on weight and balance data.
- 9.2.B Computes takeoff and landing distances from appropriate charts.
- 9.2.C Calculates fuel consumption.
- 9.2.D Charts the course.
- 9.2.E Completes a navigational log.

SAMPLE PERFORMANCE TASKS

- Plan a cross-country Visual Flight Rules (VFR) flight, collecting all pertinent information and performing all necessary calculations.
- Make a contingency plan that could be used in the event any planned navigational aid is inoperable when needed in flight.

INTEGRATION LINKAGES

Science, Math, Technology Literacy, Applied Communication, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA, Aviation Technical Education Council (ATEC), Federal Aviation Administration (FAA)

THEORY OF FLIGHT

STANDARD 10.0

Students will demonstrate communication skills required in the aviation industry.

LEARNING EXPECTATIONS

The student will:

- 10.1 Communicate and comprehend oral and written information typically occurring in the aviation workplace and in flight.
- 10.2 Solve problems and make decisions using a logical process.
- 10.3 Use teamwork skills to accomplish goals, solve problems, and manage conflict within groups.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 10.1.A Interprets and uses written information in common job formats, such as tables, charts, and reference materials and manuals.
- 10.1.B Interprets and uses graphical information such as maps.
- 10.1.C Uses electronic resources to obtain information.
- 10.1.D Analyzes information obtained from various sources.
- 10.1.E Communicates clearly and appropriately in oral and written form.
- 10.2.A Develops a hypothesis regarding the cause of a preflight problem.
- 10.2.B Tests the hypothesis to determine the solution to the preflight problem.
- 10.2.C Creates, evaluates, and revises as needed a plan to resolve a preflight problem.
- 10.3.A Serves in each of the functional roles of a team.
- 10.3.B Resolves conflicts within a group.
- 10.3.C Demonstrates appropriate and positive examples of giving and accepting criticism.
- 10.3.D Modifies behavior or revises work based on appropriate criticism.
- 10.3.E Solves problems in cooperation with other members of a group.

SAMPLE PERFORMANCE TASKS

- Use electronic reference materials to research a topic.
- Work as a team member to develop a problem-solving strategy.
- Use maps and diagrams to execute a task.
- Use professional and technical language in the classroom and laboratory.

INTEGRATION LINKAGES

Communication Skills, Teamwork Skills, Computer Skills, Reading and Writing Skills, Language Arts, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA

THEORY OF FLIGHT

STANDARD 11.0

Students will demonstrate interpersonal and employability skills required in the aviation industry.

LEARNING EXPECTATIONS

The student will:

- 11.1 Infer relationships between honesty, integrity, and organization and personal job success.
- 11.2 Demonstrate attitudes conducive to workplace success.
- 11.3 Assess implications of cultural and religious diversity for classroom and workplace relationships.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 11.1.A Illustrates the concept of integrity.
- 11.1.B Assesses the potential impact of an individual's work ethic on an organizational system.
- 11.1.C Infers the relationship between organization and personal job success.
- 11.2.A Modifies behavior to increase productivity in the classroom, laboratory and workplace.
- 11.2.B Demonstrates awareness of activities occurring concurrently in the classroom and workplace.
- 11.3. Recognizes the correlation between a clean orderly work environment and successful and efficient job.
- 11.4.A Assesses benefits and predicts problems that may arise from diversity in work teams.
- 11.4.B Devises solutions to problems arising from gender, cultural, racial, and religious diversity.
- 11.5.A Assesses the benefits of incorporating time management principles.
- 11.5.B Displays time management and work sequencing skills.

SAMPLE PERFORMANCE TASKS

- Maintain an orderly work area.
- Lead a problem-solving team.
- Consistently arrive at class on time.
- Participate in an internship in a dealership.
- Resolve an interpersonal conflict in the classroom.

INTEGRATION LINKAGES

Communication Skills, Teamwork Skills, Computer Skills, Reading and Writing Skills, Language Arts, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, Secretary's Commission on Achieving Necessary Skills, SkillsUSA-VICA

THEORY OF FLIGHT

SAMPLING OF AVAILABLE RESOURCES

FAR Parts 1, 61, and 9, Federal Aviation Regulations /14 CFR - Chapter I - Part 141 - Appendix B, Code of Federal Regulations

Private Pilot Test Prep: 2002 Edition, Federal Aviation Administration, Aviation Supplies & Academics

The Complete Private Pilot (The Complete Pilot Series) Aviation Book Co., 1997

Dictionary of Aeronautical Terms, Third Edition, Aviation Supplies & Academics

Study Guide for an Invitation to Fly: Basics for the Private Pilot, Wadsworth Pub Co, 1999

Fliers, Aviation Supplies & Academics

Confident Flying, Aviation Supplies & Academics